ANALOG DEVICES

CMOS
2V/3V/5V Low Ron Precision Switch

Preliminary Technical Data

ADG701/702

FEATURES
+1.8V to +5.5V Single Supply
1Ω On Resistance
Low On-Resistance Flatness
Bandwidth 100MHz
Rail to Rail Operation
Very Low Distortion
6-lead SOT-23
8-lead μSOIC Packages
Fast Switching Times
    t_{ON} 20 ns
    t_{OFF} 10 ns

Low Power Consumption (1μW)
TTL/CMOS Compatible

APPLICATIONS
Battery Powered Systems
Communication Systems
Sample Hold Systems
Audio Signal Routing
Video
Mechanical Reed Relay Replacement
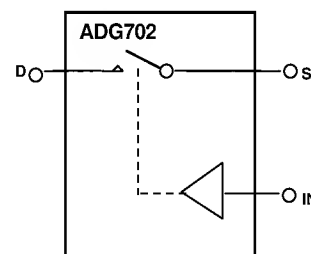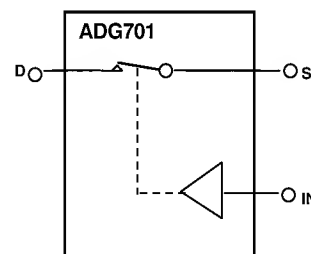A.T.E

FUNCTIONAL BLOCK DIAGRAMS

GENERAL DESCRIPTION
The ADG701/702 are monolithic CMOS SPST switches. These switches are designed on an advanced sub-micron process which provides low power dissipation yet gives high switching speed, low on resistance and low leakage currents.

The ADG701/702 can operate from a single +1.8V to +5.5V supply making it ideal for use in battery powered instruments, and with the new generation of DACs and ADCs from Analog Devices.

Each switch conducts equally well in both directions when ON.

PRODUCT HIGHLIGHTS
1. +2V/+3V/+5V Single Supply Operation. The ADG701/702 offer high performance, including low on resistance and fast switching times and is fully specified and guaranteed with +3V and +5V supply rails.

2. Low R_{ON} (4Ω max, 1Ω typ).

3. Bandwidth 100MHz

4. Low power dissipation
    CMOS construction ensures low power dissipation.

5. Fast T_{ON}/T_{OFF}

6. Tiny 6-lead SOT-23 and 8-lead μSOIC.

ADG701/702–SPECIFICATIONS[1] (V_{DD} = 5V ± 10%, GND = 0 V. All specifications -40°C to +85°C, unless otherwise noted.)

Parameter	B Version +25°C	B Version −40°C to +85°C	Units	Test Conditions/Comments
ANALOG SWITCH				
Analog Signal Range		0 V to V_{DD}		V
On-Resistance (R_{ON})	1	1.5	Ω typ	V_S = 0V to 5V
		2.5	Ω max	
On-Resistance Match Between				
Channels (ΔR_{ON})			Ω typ	
		1.0	Ω max	
On-Resistance Flatness ($R_{FLAT(ON)}$)				Ω typ
		1.0	Ω max	
LEAKAGE CURRENTS				TBD
Source OFF Leakage I_S (OFF)			nA typ	
		2.0	nA max	
Drain OFF Leakage I_D (OFF)			nA typ	
		2.0	nA max	
Channel ON Leakage I_D, I_S (ON)			nA typ	
		4.0	nA max	
DIGITAL INPUTS				
Input High Voltage, V_{INH}		2.4	V min	
Input Low Voltage, V_{INL}		0.8	V max	
Input Current				
I_{INL} or I_{INH}	0.005		μA typ	V_{IN} = V_{INL} or V_{INH}
		±0.5	μA max	
DYNAMIC CHARACTERISTICS[2]				TBD
t_{ON}		20	ns max	
t_{OFF}		10	ns max	
Charge Injection	10		pC typ	
Bandwidth -3 dB	100		MHz typ	
Bandwidth ± 0.1 dB	TBD		MHz typ	
Off Isolation	80		dB typ	
C_S (OFF)	TBD		pF typ	
C_D (OFF)	TBD		pF typ	
C_D, C_S (ON)	TBD		pF typ	
POWER REQUIREMENTS				V_{DD} = +5 V Digital Inputs = 0 V or 5 V
I_{DD}	0.0001		μA typ	
		0.5	μA max	

NOTES

[1]Temperature ranges are as follows: B Versions: −40°C to +85°C.

[2]Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

ADG701/702–SPECIFICATIONS[1] (V_{DD} = 2.7V to 3.6V, GND = 0 V. All specifications -40°C to +85°C unless otherwise noted.)
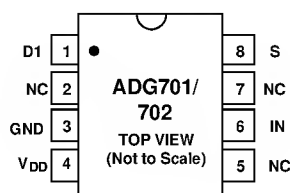
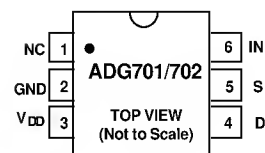| Parameter	B Version +25°C	B Version −40°C to +85°C	Units	Test Conditions/Comments
ANALOG SWITCH				
Analog Signal Range		0 V to V_{DD}		V
On-Resistance (R_{ON})	2	3	Ω typ	V_S = 0V to 3V
		4	Ω max	
On-Resistance Match Between			Ω typ	
Channels (ΔR_{ON})		1.0	Ω max	
On-Resistance Flatness ($R_{FLAT(ON)}$)			Ω typ	
		2.0	Ω max	
LEAKAGE CURRENTS				TBD
Source OFF Leakage I_S (OFF)			nA typ	
		2.0	nA max	
Drain OFF Leakage I_D (OFF)			nA typ	
		2.0	nA max	
Channel ON Leakage I_D, I_S (ON)			nA typ	
		4.0	nA max	
DIGITAL INPUTS				
Input High Voltage, V_{INH}		2.0	V min	
Input Low Voltage, V_{INL}		0.4	V max	
Input Current				
I_{INL} or I_{INH}	0.005		μA typ	V_{IN} = V_{INL} or V_{INH}
		±0.5	μA max	
DYNAMIC CHARACTERISTICS[2]				TBD
t_{ON}		30	ns max	
t_{OFF}		15	ns max	
Charge Injection	5		pC typ	
Bandwidth -3dB	110		MHz typ	
Bandwidth ± 0.1dB	TBD		MHz typ	
Off Isolation	80		dB typ	
C_S (OFF)	TBD		pF typ	
C_D (OFF)	TBD		pF typ	
C_D, C_S (ON)	TBD		pF typ	
POWER REQUIREMENTS				V_{DD} = +3 V, Digital Inputs = 0 V or 3 V
I_{DD}	0.0001		μA typ	
		0.5	μA max	

NOTES
[1]Temperature ranges are as follows: B Versions: −40°C to +85°C.
[2]Guaranteed by design, not subject to production test.
Specifications subject to change without notice.

PIN CONFIGURATION
(MICRO SOIC)

```
D1   [1]  ●           [8]  S
NC   [2]   ADG701/    [7]  NC
             702
GND  [3]   TOP VIEW   [6]  IN
VDD  [4]  (Not to Scale) [5]  NC
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PIN CONFIGURATION
(SOT-23)

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NC   [1]  ●           [6]  IN
GND  [2]  ADG701/702  [5]  S
VDD  [3]   TOP VIEW   [4]  D
          (Not to Scale)
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ABSOLUTE MAXIMUM RATINGS[1]
(T_A = +25°C unless otherwise noted)

V_{DD} to GND . . . . –0.3 V to +7 V

Analog, Digital Inputs[2] . . . . -0.3V to V_{DD} +0.3 V or
30 mA, Whichever Occurs First

(Pulsed at 1 ms, 10% Duty Cycle max)
Operating Temperature Range
   Industrial (B Version) . . . .–40°C to +85°C
Storage Temperature Range . . . .–65°C to +150°C
Junction Temperature . . . . +150°C
MicroSOIC Package, Power Dissipation . . . . 450 mW
   θ_{JA} Thermal Impedance . . . . 206°C/W
   θ_{JC} Thermal Impedance . . . . 44°C/W
   Lead Temperature, Soldering
      Vapor Phase (60 sec) . . . . +215°C
      Infrared (15 sec) . . . . +220°C
SOT-23 Package, Power Dissipation . . . . TBD mW
   θ_{JA} Thermal Impedance . . . . 229.6°C/W
   θ_{JC} Thermal Impedance . . . . 91.99°C/W
   Lead Temperature, Soldering
      Vapor Phase (60 sec) . . . . +215°C
      Infrared (15 sec) . . . . +220°C
ESD 2kV

NOTES
[1]Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Only one absolute maximum rating may be applied at any one time.
[2]Overvoltages at IN, S or D will be clamped by internal diodes. Current should be limited to the maximum ratings given.

ORDERING GUIDE

Model[1]	Temperature Range	Package Option[1]
ADG701BRT	–40°C to +85°C	RT-6
ADG702BRT	–40°C to +85°C	RT-6
ADG701BRM	–40°C to +85°C	RM-8
ADG702BRM	–40°C to +85°C	RM-8

NOTES
[1]RT = SOT-23; RM = microSOIC.

CAUTION
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADG701/702 feature proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

TERMINOLOGY

V_{DD} Most positive power supply potential.

GND   Ground (0 V) reference.

S   Source terminal. May be an input or output.

D   Drain terminal. May be an input or output.

IN   Logic control input.

R_{ON} Ohmic resistance between D and S.

ΔR_{ON} On resistance match between any two channels i.e. R_{ON}max - R_{ON}min .

$R_{FLAT(ON)}$ Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal range.

I_S (OFF)   Source leakage current with the switch "OFF."

I_D (OFF)   Drain leakage current with the switch "OFF."

I_D, I_S (ON)   Channel leakage current with the switch "ON."

V_D (V_S)   Analog voltage on terminals D, S.

C_S (OFF)   "OFF" switch source capacitance.

C_D (OFF)   "OFF" switch drain capacitance.

C_D, C_S (ON)   "ON" switch capacitance.

t_{ON} Delay between applying the digital control input and the output switching on. See test circuit 4.

t_{OFF} Delay between applying the digital control input and the output switching off.

Off Isolation   A measure of unwanted signal coupling through an "OFF" switch.

Charge Injection   A measure of the glitch impulse transferred from the digital input to the analog output during switching.

MECHANICAL INFORMATION

Dimensions are shown in inches and (mm).

8-Pin microSOIC
(RM-8)

6-Pin SOT23
(RT-6)